Geosynchronous Microwave (GEM) Sensor for Hydrological Imaging and Profiling

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The GEosynchronous Microwave (GEM) sensor is a new concept for continuous mapping of clouds and precipitation and profiling of temperature and moisture fields. GEM will provide, for the first time, high-resolution time-resolved maps of convective clouds and raincells within tropical and midlatitude hurricane cores and frontal boundaries below cirrus cover and at spatial resolutions comparable to or exceeding those of the NOAA AMSU sensors. The information from GEM will be complementary to that provided by the current and future NOAA GOES infrared sensors and NOAA and NASA polar orbiting microwave sensors, including those planned for GPM and NPOESS.

The baseline GEM concept uses a ~2 meter diameter center-fed filled aperture reflector antenna with fast-scanning (rotating/translating, and possibly morphing) subreflector. The subreflector provides a narrow-field rapid scan capability, with a wide-field slow scan provided by motion of the entire antenna. A recently proposed European version (the Geostationary Observatory for Microwave Atmospheric Sounding, or GOMAS) will improve somewhat on the resolution figures through the use of a larger antenna. GEM/GOMAS will incorporate several advanced technologies, including steerable momentum-compensated precision reflectors, microscanning subreflectors, broadband millimeter- and submillimeter-wave radiometers, and image enhancements using super-resolution techniques. Engineering studies have already shown that the modest size and weight of GEM permit its incorporation on future GOES R+ platforms.

GEM will be capable of either intensively observing specific areas near severe weather events or obtaining synoptic meteorological information over an extended environment. In its intensive observing mode GEM will provide measurements of temperature and moisture profiles above 2-5 km altitude within optically opaque cirrus shields at ~50 km spatial resolution, and imagery of precipitation within mesoscale convective systems at ~15 km resolution over the complete life cycle of a storm. The nominal update time for imaging a region of ~1500 km x 1500 km will be ~15 minutes. Larger fields of view will permit full CONUS imaging in approximately one hour.

The ability to continuously monitor precipitation and weather patterns through obscuring clouds on a hemispheric basis will be a unique asset for operational nowcasting and forecasting. GEM would complement the capabilities of the future NASA GIFTS instrument by both extending the sounding capabilities of GIFTS to cloudy regions and providing improved cloud-clearing. Additional data products are anticipated to include measurements of cirrus cloud ice content and (potentially) cloud-drift winds below cirrus layers.